

unless surrogate testing is required under S4.1.1.

S5.2.2 The specimen is produced by cutting the material in the direction that provides the most adverse test results. The specimen is oriented so that the surface closest to the occupant compartment air space faces downward on the test frame.

S5.2.3 Material with a napped or tufted surface is placed on a flat surface and combed twice against the nap with a comb having seven to eight smooth, rounded teeth per inch.

S5.3 *Procedure.*

(a) Mount the specimen so that both sides and one end are held by the U-shaped frame, and one end is even with the open end of the frame. Where the maximum available width of a specimen is not more than 2 inches, so that the sides of the specimen cannot be held in the U-shaped frame, place the specimen in position on wire supports as described in S5.1.3, with one end held by the closed end of the U-shaped frame.

(b) Place the mounted specimen in a horizontal position, in the center of the cabinet.

(c) With the flame adjusted according to S5.1.4, position the bunsen burner and specimen so that the center of the burner tip is three-fourths of an inch below the center of the bottom edge of the open end of the specimen.

(d) Expose the specimen to the flame for 15 seconds.

(e) Begin timing (without reference to the period of application of the burner flame) when the flame from the burning specimen reaches a point 1½ inches from the open end of the specimen.

(f) Measure the time that it takes the flame to progress to a point 1½ inches from the clamped end of the specimen. If the flame does not reach the specified end point, time its progress to the point where flaming stops.

(g) Calculate the burn rate from the formula

$$B=60 \times (D/T)$$

Where:

B=Burn rate in inches per minute,

D=Length the flame travels in inches, and

T=Time in seconds for the flame to travel D inches.

[36 FR 22902, Dec. 2, 1971, as amended at 40 FR 14319, Mar. 31, 1975; 40 FR 42747, Sept. 16, 1975; 40 FR 56667, Dec. 4, 1975]

§ 571.303 Standard No. 303; Fuel system integrity of compressed natural gas vehicles.

S1. *Scope.* This standard specifies requirements for the integrity of motor vehicle fuel systems using compressed natural gas (CNG), including the CNG fuel systems of bi-fuel, dedicated, and dual fuel CNG vehicles.

S2. *Purpose.* The purpose of this standard is to reduce deaths and injuries occurring from fires that result from fuel leakage during and after motor vehicle crashes.

S3. *Application.* This standard applies to passenger cars, multipurpose passenger vehicles, trucks and buses that have a gross vehicle weight rating (GVWR) of 10,000 pounds or less and use CNG as a motor fuel. This standard also applies to school buses regardless of weight that use CNG as a motor fuel.

S4. *Definitions.*

Bi-fuel CNG vehicle means a vehicle equipped with two independent fuel systems, one of which is designed to supply CNG and the second to supply a fuel other than CNG.

CNG fuel container means a container designed to store CNG as motor fuel onboard a motor vehicle.

CNG fuel system means all components used to store or supply CNG to a vehicle's engine.

Dedicated CNG vehicle means a vehicle equipped with one fuel system and designed to operate on CNG.

Dual-fuel CNG vehicle means a vehicle which is fueled by two fuels simultaneously, one of which is CNG and the second is a fuel other than CNG.

High pressure portion of a fuel system means all the components from and including each CNG fuel container up to, but not including, the first pressure regulator.

Service pressure means the internal pressure of a CNG fuel container when filled to design capacity with CNG at 20° Celsius (68° Fahrenheit).

S5. *General requirements.*

S5.1 *Vehicle requirements.*

S5.1.1 *Vehicles with GVWR of 10,000 pounds or less.* Each passenger car, multipurpose passenger vehicle, truck, and bus with a GVWR of 10,000 pounds or less that uses CNG as a motor fuel and that is manufactured on or after September 1, 1995 shall meet the requirements of S6, except S6.4.

S5.1.2 *Schoolbuses with a GVWR greater than 10,000 pounds.* Each schoolbus with a GVWR greater than 10,000 pounds that uses CNG as a motor fuel and that is manufactured on or after September 1, 1995 shall meet the requirements of S6.4.

S5.2 *Fuel system pressure drop: barrier crash.*

(a) For all vehicles, the pressure drop in the high pressure portion of the fuel system, expressed in kiloPascals (kPa), in any fixed or moving barrier crash from vehicle impact through the 60 minute period following cessation of motion shall not exceed:

- (1) 1062 kPa (154 psi), or
- (2) $895 (T/V_{FS})$; whichever is higher

where T is the average temperature of the test gas in degrees Kelvin, stabilized to ambient temperature before testing, where average temperature (T) is calculated by measuring ambient temperature at the start of the test time and then every 15 minutes until the test time of 60 minutes is completed; the sum of the ambient temperatures is then divided by five to yield the average temperature (T); and where V_{FS} is the internal volume in liters of the fuel container and the fuel lines up to the first pressure regulator.

(b) For bi-fuel or dual fuel CNG vehicles, the test requirement in S5.2(a) shall apply to the CNG fuel system, and the test requirement of Standard No. 301 shall apply to the other fuel system, if that standard is applicable.

S5.3 Each CNG vehicle shall be permanently labeled, near the vehicle refueling connection, with the information specified in S5.3.1 and S5.3.2 of this section. The information shall be visible to a person standing next to the vehicle during refueling, in English, and in letters and numbers that are not less than 4.76 mm (3/16 inch) high.

S5.3.1 The statement: "Service pressure _____ kPa (_____ psig)."

S5.3.2 The statement "See instructions on fuel container for inspection and service life."

S5.4 When a motor vehicle is delivered to the first purchaser for purposes other than resale, the manufacturer shall provide the purchaser with a written statement of the information in S5.3.1 and S5.3.2 in the owner's manual, or, if there is no owner's manual, on a one-page document. The information shall be in English and in not less than 10 point type.

S6. *Test requirements: fuel system integrity.* Each vehicle with a GVWR of 10,000 pounds or less shall meet the requirements of any applicable barrier crash test. A particular vehicle need not meet further requirements after having been subjected to a single barrier crash test.

S6.1 *Frontal barrier crash.* When the vehicle traveling longitudinally forward at any speed up to and including 30 mph impacts a fixed collision barrier that is perpendicular to the line of travel of the vehicle, or at any angle up to 30 degrees in either direction from the perpendicular to the line of travel of the vehicle, with 50th percentile test dummies as specified in part 572 of this chapter at each front outboard designated seating position and at any other position whose protection system is required to be tested by a dummy under the provisions of Standard No. 208, under the applicable conditions of S7, the fuel pressure drop shall not exceed the limits of S5.2.

S6.2 *Rear moving barrier crash.* When the vehicle is impacted from the rear by a barrier moving at any speed up to and including 30 mph, with test dummies as specified in part 572 of this chapter at each front outboard designated seating position, under the applicable conditions of S7, the fuel pressure drop shall not exceed the limits of S5.2.

S6.3 *Lateral moving barrier crash.* When the vehicle is impacted laterally on either side by a barrier moving at any speed up to and including 20 mph with 50th percentile test dummies as specified in part 572 of this chapter at positions required for testing to Standard No. 208, under the applicable conditions of S7, the fuel pressure drop shall not exceed the limits of S5.2.

S6.4 Moving contoured barrier crash. When the moving contoured barrier assembly traveling longitudinally forward at any speed up to and including 30 mph impacts the test vehicle (schoolbus with a GVWR exceeding 10,000 pounds) at any point and angle, under the applicable conditions of S7, the fuel pressure drop shall not exceed the limits of S5.2.

S7. Test conditions. The requirements of S5 and S6 shall be met under the following conditions. Where a range of conditions is specified, the vehicle must be capable of meeting the requirements at all points within the range.

S7.1 General test conditions. The following conditions apply to all tests.

S7.1.1 Each fuel storage container is filled to 100 percent of service pressure with nitrogen, N₂. The gas pressure shall stabilize to ambient temperature before testing may be conducted.

S7.1.2 After each fuel storage container is filled as specified in S7.1.1, the fuel system other than each fuel storage container is filled with nitrogen, N₂, to normal operating pressures. All manual shutoff valves are to be in the open position.

S7.1.3 In meeting the requirements of S6.1 through S6.4, if the vehicle has an electrically driven fuel pump that normally runs when the vehicle's electrical system is activated, it is operating at the time of the barrier crash. If the vehicle has any high pressure electric shutoff valve that is normally open when the electrical system is activated, it is open at the time of the barrier crash. Furthermore, if any electric shutoff valve prevents sensing of system pressure by the pressure transducer when closed, it must be open for both the initial pressure measurement and the pressure measurement 60 minutes after the vehicle ceases motion from impact. Any valve shall be open for a period of one minute to equalize the system pressure.

S7.1.4 The parking brake is disengaged and the transmission is in neutral, except that in meeting the requirements of S6.4, the parking brake is set.

S7.1.5 Tires are inflated to manufacturer's specifications.

S7.1.6 The vehicle, including test devices and instrumentation, is loaded as follows:

(a) A passenger car, with its fuel system filled as specified in S7.1.1 and S7.1.2, is loaded to its unloaded vehicle weight plus its rated cargo and luggage capacity weight, secured in the luggage area, plus the necessary test dummies as specified in S6, restrained only by means that are installed in the vehicle for protection at its seating position.

(b) A multipurpose passenger vehicle, truck, or bus with a GVWR of 10,000 pounds or less, whose fuel system is filled as specified in S7.1.1 and S7.1.2, is loaded to its unloaded vehicle weight, plus the necessary test dummies as specified in S6, plus 136.1 kilograms (kg.) (300 pounds (lb.)), or its rated cargo and luggage capacity weight, whichever is less, secured to the vehicle and distributed so that the weight on each axle as measured at the tire-ground interface is in proportion to its GAWR. Each dummy shall be restrained only by means that are installed in the vehicle for protection at its seating position.

(c) A schoolbus with a GVWR greater than 10,000 pounds, whose fuel system is filled as specified in S7.1.1 and S7.1.2, is loaded to its unloaded vehicle weight, plus 54.4 kg. (120 lb.) of unsecured weight at each designated seating position.

S7.1.7 The ambient temperature is not to vary more than 5.6 °C (10 °F) during the course of the test.

S7.1.8 The pressure drop measurement specified in S5.2 is to be made using a location on the high pressure side of the fuel system in accordance with the vehicle manufacturer's recommendation.

S7.2 Lateral moving barrier crash test conditions. The lateral moving barrier crash test conditions are those specified in S8.2 of Standard No. 208, 49 CFR 571.208.

S7.3 Rear moving barrier test conditions. The rear moving barrier test conditions are those specified in S8.2 of Standard No. 208, 49 CFR 571.208, except for the positioning of the barrier and the vehicle. The barrier and test vehicle are positioned so that at impact—

(a) The vehicle is at rest in its normal attitude;

(b) The barrier is traveling at any speed up to and including 30 mph with its face perpendicular to the longitudinal centerline of the vehicle; and

(c) A vertical plane through the geometric center of the barrier impact surface and perpendicular to that surface coincides with the longitudinal centerline of the vehicle.

S7.4 Moving contoured barrier test conditions. The moving contoured barrier crash test conditions are those specified in S7.5 of Standard No. 301, 49 CFR 571.301.

[59 FR 19659, Apr. 25, 1994; as amended at 60 FR 2543, Jan. 10, 1995; 60 FR 57948, Nov. 24, 1995]

§ 571.304 Standard No. 304; Compressed natural gas fuel container integrity.

S1. Scope. This standard specifies requirements for the integrity of compressed natural gas (CNG), motor vehicle fuel containers.

S2. Purpose. The purpose of this standard is to reduce deaths and injuries occurring from fires that result from fuel leakage during and after motor vehicle crashes.

S3. Application. This standard applies to containers designed to store CNG as motor fuel on-board any motor vehicle.

S4. Definitions.

Brazing means a group of welding processes wherein coalescence is produced by heating to a suitable temperature above 800 °F and by using a nonferrous filler metal, having a melting point below that to the base metals. The filler metal is distributed between the closely fitted surfaces of the joint by capillary attraction.

Burst pressure means the highest internal pressure reached in a CNG fuel container during a burst test at a temperature of 21 °C (70 °F).

CNG fuel container means a container designed to store CNG as motor fuel on-board a motor vehicle.

Fill pressure means the internal pressure of a CNG fuel container attained at the time of filling. Fill pressure varies according to the gas temperature in the container which is dependent on the charging parameters and the ambient conditions.

Full wrapped means applying the reinforcement of a filament or resin sys-

tem over the entire liner, including the domes.

Hoop wrapped means winding of filament in a substantially circumferential pattern over the cylindrical portion of the liner so that the filament does not transmit any significant stresses in a direction parallel to the cylinder longitudinal axis.

Hydrostatic pressure means the internal pressure to which a CNG fuel container is taken during testing set forth in S5.4.1.

Liner means the inner gas tight container or gas cylinder to which the overwrap is applied.

Service pressure means the internal settled pressure of a CNG fuel container at a uniform gas temperature of 21 °C (70 °F) and full gas content. It is the pressure for which the container has been constructed under normal conditions.

Stress ratio means the stress in the fiber at minimum burst pressure divided by the stress in the fiber at service pressure.

S5 Container and material requirements.

S5.1 Container designations. Container designations are as follows:

S5.1.1 Type 1—Non-composite metallic container means a metal container.

S5.1.2 Type 2—Composite metallic hoop wrapped container means a metal liner reinforced with resin impregnated continuous filament that is “hoop wrapped.”

S5.1.3 Type 3—Composite metallic full wrapped container means a metal liner reinforced with resin impregnated continuous filament that is “full wrapped.”

S5.1.4 Type 4—Composite non-metallic full wrapped container means resin impregnated continuous filament with a non-metallic liner “full wrapped.”

S5.2 Material designations.

S5.2.1 Steel containers and liners.

(a) Steel containers and liners shall be of uniform quality. Only the basic oxygen or electric furnace processes are authorized. The steel shall be aluminum killed and produced to predominantly fine grain practice. The steel heat analysis shall be in conformance with one of the following grades: